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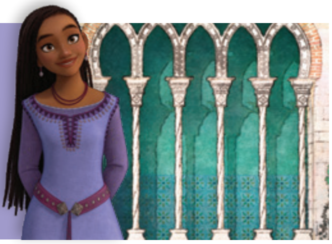

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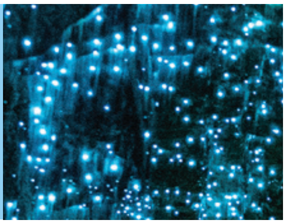

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COVER: OUR WILD LIFE PHOTOGRAPHY / ALAMY (HARE); PETE OXFORD / NATURE PICTURE LIBRARY (CRAB); © 2023 DISNEY ENTERPRISES INC. ALL RIGHTS RESERVED. (VALENTINO); LINDA KENNEDY / ALAMY (OTTERS). PAGE 3: ERLEND HAARBERG / NATIONAL GEOGRAPHIC IMAGE COLLECTION (HARE); © 2023 DISNEY ENTERPRISES INC. ALL RIGHTS RESERVED. (*WISH* BACKGROUND); VISUAL DEVELOPMENT ART BY GRISELDA SASTRAWINATA-LEMAY / © 2023 DISNEY ENTERPRISES INC. ALL RIGHTS RESERVED. (ASHA); © 2021 SHAUN JEFFERS (CAVE); CLAYTON HANMER (ILLUSTRATION); C J ELLIS PHOTOGRAPHY / ALAMY (OTTER)

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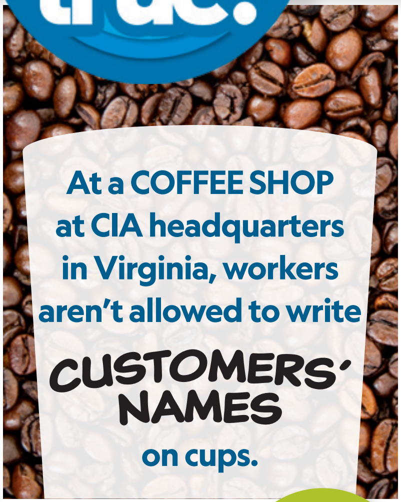
Weird but true!

Check out these outrageous facts.

BY JULIE BEER AND MICHELLE HARRIS



At a COFFEE SHOP at CIA headquarters in Virginia, workers aren't allowed to write **CUSTOMERS' NAMES** on cups.

A HEDGEHOG HAS ABOUT **6,000 QUILLS.**

The noises TASMANIAN DEVILS make while eating can be heard OVER A MILE AWAY.

IN 1887, A MAN CLAIMED TO FIND A **SNOWFLAKE** THAT WOULD'VE BEEN BIGGER THAN TODAY'S **DINNER PLATES.**

You could buy Thanksgiving-themed **gumballs** with flavors such as cranberry, turkey, and pumpkin pie.

MOOSE are also called **RUBBER-NOSED** swamp donkeys.

CHECK OUT THE BOOK!

© SPLOSH / DREAMSTIME (COFFEE BEANS); AMERICAN IMAGES INC / SUPERSTOCK (HEDGEHOG); FLASH-KA / SHUTTERSTOCK (TASMANIAN DEVIL); CHRISTIAN SCHOISSINGEYER / SHUTTERSTOCK (MOOSE)

GUINNESS WORLD RECORDS

BIRD COMING THROUGH!

BY KAY BOATNER

PARROT RIDES SCOOTER

Wild cockatoos return to the same nests every year.

Chico the cockatoo is the speediest parrot around—on a scooter, at least. The bird holds the record for the fastest five meters (16.4 feet) on a scooter by a parrot, traveling the distance in 14.58 seconds. Chico broke his own record, shaving off three seconds from his previous scooter ride. Make way for Chico!

GIANT WAFFLE STACK

Hope you're hungry! The world's tallest stack of waffles stands three feet tall—that's about the height of a standard-size baseball bat. Brothers Francis and Michel De Buck of Belgium cooked the waffles longer than usual to make sure they were firm enough to stack so high. We're going to need a *lot* of syrup.

REALLY LONG LOCKS

Talk about a good hair day. With hair stretching nearly 20 feet, Asha Mandela holds the record for the longest locks. (Locks are ropelike strands of hair formed by matting, twisting, or braiding.) Weighing 42 pounds, the hair takes two days to wash and dry. That's probably because Mandela prefers the sun to a hair dryer.

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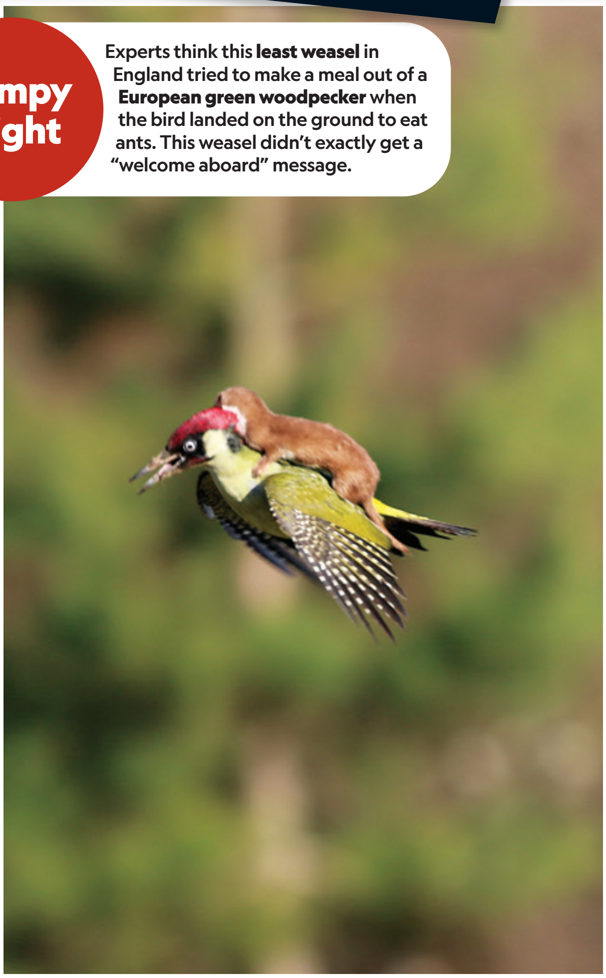
Moment of Whee!

All aboard for these pics of wild rides!

BY ALLYSON SHAW

Bumpy Flight

Experts think this **least weasel** in England tried to make a meal out of a **European green woodpecker** when the bird landed on the ground to eat ants. This weasel didn't exactly get a "welcome aboard" message.



Safe Spot

Hang tight! Baby **sloth bears** climb onto their mothers' backs for rides. That keeps them safe from hungry tigers and leopards in South Asia.

Sun 'n' Surf

Like all reptiles, **serrated hinged terrapins** sunbathe to raise their internal body temperature. Usually, they catch rays on rocks or logs. But for this turtle in Kruger National Park in South Africa, a **hippopotamus's** head works, too.

Free Meal

As the **capybara** walks through grass, birds like this **cattle tyrant** in Brazil feast on the insects trying to get out of the way. Hold the ketchup!

SEE MORE ANIMAL PHOTOS!
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MARTIN LE-MAY (WEASEL AND WOODPECKER); AXEL GOMILLE / MINDEN PICTURES (SLOTH BEARS); JON KERRIN / CATERS NEWS (TURTLE AND HIPPOPOTAMUS); MARY ANN MCDONALD / GETTY IMAGES (CAPYBARA AND CATTLE TYRANT)

Bet You Didn't Know!

7 pizza facts to snack on

BY PAIGE TOWLER

1 Legend has it that one popular **pizza**—made with **red** tomato sauce, **white** mozzarella, and **green** basil—was created to match the **Italian flag's** colors.

2 When **dough** is tossed, the **spinning** motion helps it spread out **without tearing.**

3 Created in **Chicago** in the 1940s, **deep-dish pizza** is baked in a pan with **sauce on top** of the cheese.

4 In 2021, **astronauts** on the International Space Station had the first-ever **pizza party** in **space.**

5 One restaurant in **Australia** serves pizzas with toppings that include **crocodile** and **kangaroo.**

6 Eaten in **Argentina,** ***fugazza*** features a thick crust, lots of onions and cheese, and **no sauce.**

7 Scientists think **cold pizza** tastes better to some people because the cooler temperatures bring out the **cheesy** and **salty flavors.**

OKSANA MIZINA / SHUTTERSTOCK

awes8me

BY SARAH WASSNER FLYNN AND BRITTANY MOYA DEL PINO

THE HOLE PICTURE

PEER INTO THESE CAVES AND CRATERS TO VIEW EARTH'S DEEPEST, DARKEST SECRETS.

1 DEEP BLUE

If you plopped a hollow mountain on top of a 65-foot-deep swimming hole, you'd have something like Utah's **Homestead Crater.** The natural hot spring makes swimming inside this "covered pool" a year-round event.

2 EYE TO THE SKY

The 1,638-foot-deep **Cave of Swallows** in Mexico is popular with underground explorers. Named for the birds that fly overhead, this cave is so chilly near the bottom that clouds actually form inside.

3 UNDERGROUND ADVENTURES

Mamet Cave in Croatia is 656 feet deep—roomy enough to have landed a hot-air balloon into its depths. The cave is shaped like an upside-down funnel: It's 197 feet across at the top and becomes wider the deeper it gets.

A HOT-AIR BALLOON DESCENDS INTO MAMET CAVE FOR THE FIRST TIME, IN 2014.

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4 GASSED UP

In 2014, scientists in Russia found several huge, mysterious **Arctic craters.** They think that a natural gas called methane built up in large pockets, some as big as Olympic-size swimming pools, and got trapped in the frozen ground. When the gas escaped, it made a sudden explosion that no one heard. *Kaboom!*

6 ROCKY RETREAT

A popular tourist attraction in central Vietnam, **Paradise Cave** extends 19 miles belowground. Sparkling stalactites (stuh-LAC-tites) hang from cathedral-like ceilings, and an underground river flows through the caverns.

7 ONE FOR THE RECORDS

The year 1815 was unusually cold. Why? That's when the biggest volcanic eruption in recorded history shaded Earth's atmosphere with ash. The **Mount Tambora** explosion in Indonesia also created a crater in the volcano (called a caldera) 3.7 miles wide and 3,609 feet deep.

5 WHAT'S THE MATTER?

For more than a century, miners dug up South Dakota's **Homestake Mine** to uncover gold and silver. But today, physicists are using those deep chambers—some as far down as 8,000 feet—to search for something completely different: dark matter. Scientists think the invisible but massive stuff is the gravitational force that pulls galaxies together and fills more than a quarter of our universe.

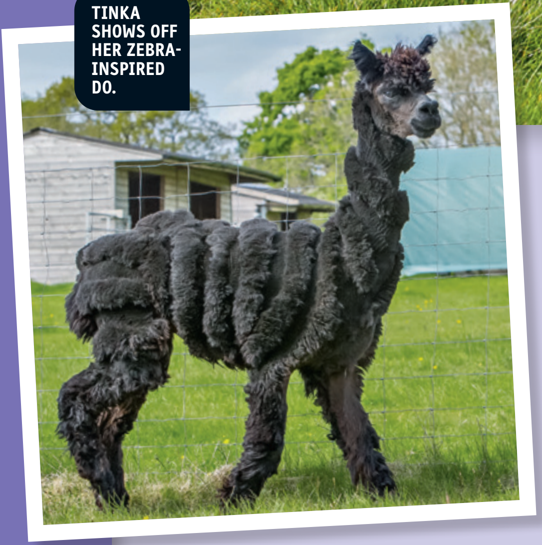
8 WATER DAMAGE

Sinkholes are usually caused by underground streams that dissolve rock. But geologists suspect the **Guatemala City sinkhole**, a gaping hole deep enough to swallow a three-story building, was caused by leaky pipes beneath the Central American city in 2010.

AMAZING ANIMALS

OTTIE (FAR LEFT) AND BONSO HAVE BEEN SHEARED TO LOOK LIKE A POODLE AND A *STEGOSAURUS.*

Crazy Alpaca Haircuts



TINKA SHOWS OFF HER ZEBRA-INSPIRED DO.

Cirencester, England

It's hard to miss Ottie, Tinka, and Bonso the alpacas. Their hilarious hairdos make them and the other members of their herd look sort of like different animals—including a zebra, a poodle, and even a dinosaur!

Helen Kendall Smith wanted to do something special to celebrate her 10th year as an alpaca breeder, so she decided to give 10 of her animals crazy cuts. First she sketched out the shapes before hiring a professional shearer to transform the animals. Alpacas are used to being sheared every year so their owners can sell the wool, plus it keeps them cool. That's why none of the animals minded getting their new stop-and-stare styles. (They received normal haircuts shortly after.)

How did Kendall Smith pick which alpacas would get the special cuts? "I chose the ones that love attention," she says, "the ones that have that 'look at me!' attitude." Her favorite is the dinosaur do on Bonso. "When he's in the field with his head underneath a tree to eat leaves, he really does look like a dinosaur!" —*Sara Schwartz*

RAISE THE "ROO"F!

Kangaroo Climbs Roof

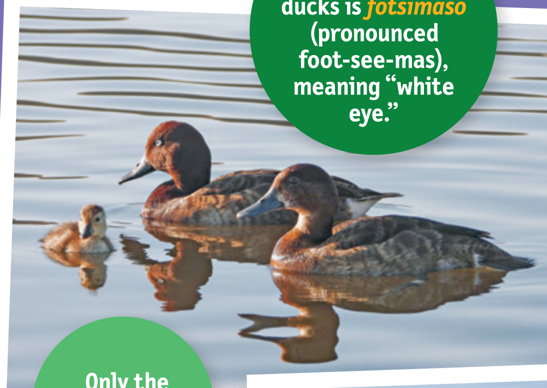
ANTILOPINE KANGAROO

KANGAROO

Mount Isa, Australia
A group of passersby jumped at the chance to help an antilopine kangaroo stuck on the roof of a one-story house.

Kangaroo expert Dianne Pearson says kangaroos often hang out in rural or wooded areas near cities. But they usually stay away from buildings and areas with lots of people. "It might have hopped on the roof after being scared by another animal or a loud noise," she says. "But we don't know how it got up there!"

The kind citizens called the local fire department to help. Climbing to the roof, the rescuers shooed the kangaroo toward the back, which sloped closer to the ground. Soon the animal jumped down into the backyard bushes and bounced away unharmed. Stay hoppy, 'roo! —*Stephanie Rudig*



The local name for these ducks is *fotsimaso* (pronounced foot-see-mas), meaning "white eye."

Only the males have white eyes.

COMEBACK CRITTER: Madagascar Pochard

Lake Sofia, Madagascar
Biologist Lily-Arison Rene de Roland was scanning a lake with binoculars when he saw something amazing—ducks with white eyes. He realized he'd found a group of Madagascar pochards, birds that were declared extinct in 1993. "It was like a dream," says Rene de Roland, who's also a National Geographic Explorer.

Nobody knows how these 13 ducks got from their previous home to the remote volcanic lake or how long they'd been there—but the species was in trouble. This lake is deep, cold, and doesn't have many bugs to eat, so not many ducklings were surviving.

The scientists hatched a plan. They gathered the eggs from the lake and raised the ducklings in captivity. Since then, the conservationists have released 111 adult ducks in a protected lake called Lake Sofia, and scientists continue to monitor the ducks still living at the volcanic lake. Having two populations of these birds increases the species' chance of survival—an *egg*-cellent plan!
—*Carol Huang*

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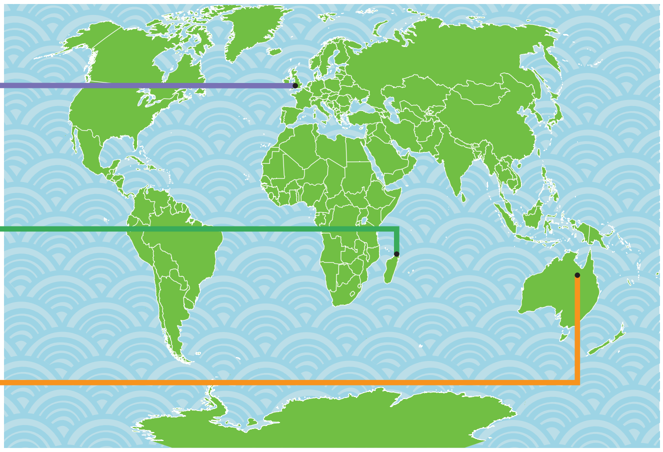
SAVE THE EARTH

ALPACAS
Cirencester, England

DUCKS
Lake Sofia, Madagascar

KANGAROO
Mount Isa, Australia



FRANCIS HAWKINS / SWNS (ALPACAS, BOTH); ETIENNE LITTLEFAIR / NPL / MINDEN PICTURES (ANTOLOPINE KANGAROO); PAULA BOON (KANGAROO ON ROOF); DURRELL WILDLIFE CONSERVATION TRUST (MADAGASCAR POCHARDS, BOTH)

Chillin'

5 ways mountain hares thrive in their harsh habitat

BY JED WINER

A blizzard is pounding the highlands of northern Scotland. Sitting on a hillside, a mountain hare doesn't seem to care about the near-zero temperature and 60-mile-an-hour wind gusts. It needs to eat.

The hare turns its back to the wind and uses its big hind feet to push aside the powder. Buried below is a shrub called heather. Food!

Searching for meals in the middle of a snowstorm doesn't sound fun, but mountain hares are built for it. Over millions of years, they've evolved to survive in chilly regions across much of northern Europe and as far east as Japan.

"Mountain hares are at home in freezing temperatures," wildlife biologist Carlos Bedson says. "They've completely adapted to cold climates." Check out five ways these hares hop through life in the snow.

ANDREW PARKINSON / NATIONAL GEOGRAPHIC IMAGE COLLECTION (TWO HARES); SCOTLAND: THE BIG PICTURE / MINDEN PICTURES (HARE)

Out

A MOUNTAIN HARE HUDDLES IN A SHELTER CALLED A FORM ATOP SNOW-COVERED PLANTS.

1 BYE-BYE, BREEZE

To escape the winter wind, mountain hares spend the daytime resting in "forms," which are snowy, nestlike shelters they create on the ground. Some are used for decades by different mountain hares.

When they want to create new forms in winter, hares crawl onto clumps of snow-covered heather or other thick vegetation and sit on part of it to squash it down. Sometimes they'll nibble around the edges of plants peeking through the snow to shape the form around their bodies. "The forms are low down in the heather and keep the hares out of the cold," Bedson says. "They're a cozy, easy-to-make shelter."

The forms also help the critters hide from predators like golden eagles and red foxes. But mountain hares still stay alert. They only sleep for a few minutes at a time—and they keep their eyes half open. "These hares are almost always on the lookout for predators," wildlife biologist Stéphanie Schai-Braun says.

HARE VS. RABBIT

These speedy creatures *look* alike, but hares and rabbits are actually very different. Check out this chart to discover how.

	HARE	RABBIT
Fur Facts	Hares are reddish brown with pale bellies. Some change color in different seasons.	A rabbit's gray-brown fur usually stays the same color year-round.
Tail Tales	Hares often have black-tipped white tails.	Rabbits have fluffy, white, cotton-ball-like tails.
Home Sweet Home	Except for moms with babies, hares live alone in hollow logs or grass nests.	Rabbits live together in underground burrow systems called warrens. They might also stay in dens made by other animals.
Measuring Up	Hares can grow to more than two feet long and weigh up to 11 pounds.	Wild rabbits are smaller, growing to one and a half feet long and weighing up to six pounds.
Need for Speed	Hares are faster than rabbits, reaching speeds of 45 miles an hour.	Rabbits reach speeds of 25 miles an hour. (That's still pretty fast!)
Let's Eat	Hares snack on plant shoots, twigs, and bark.	Rabbits prefer grasses and vegetables with leafy tops, such as carrots.
Baby Names	Newborn hares are called leverets.	Baby rabbits are called kits or kittens.

2 BUILT-IN SNOWSHOES

Like snowshoes that people wear to walk across deep snow, mountain hares use their hairy, webbed hind feet to avoid sinking into snow. "Mountain hares spread out their toes to sort of 'float' on top of the snow as they hop along," wildlife ecologist Simen Pedersen says. "This helps them get away from predators like foxes that might struggle in snow."

These hares also have long, powerful hind legs that are built for speed and allow them to dart off at up to 45 miles an hour when they're spooked. "They can accelerate faster than some cars," Bedson says. And the hares use their shorter front legs to make a quick, uphill escape from predators that can't move as well in the mountains. "Nothing runs uphill as fast as a mountain hare," Bedson says. "And the hares know that!"

FURRY FOOT

FALL

MOLTING

WINTER

3 BLENDING IN

A white coat helps mountain hares camouflage themselves against their snowy surroundings, making it more difficult for predators to spot them. So as winter approaches, the brown coat they sport in warmer months gradually molts, or sheds and regrows. The new fur is white.

A hare's winter coat is also thicker to provide the warmth the critter needs to survive in the bitter cold. That's because in the winter, their hairs are filled with air that traps their body heat, just like a puffy parka is filled with air to trap *your* body heat. (In the summer, the hairs are filled with pigment, or coloring, that turns their fur brown.)

As days get longer in spring, leading to warmer temperatures, the hares shed their white winter coats and grow brown fur that blends in better against a snow-free landscape. "It's like when your dog or cat sheds fur in the spring," wildlife biologist Marketa Zimova says. "They don't need all that extra heat in the warmer seasons."

SEE CUTE RABBITS!
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4 TRICKY TRACKS

A mountain hare's tracks are easy for predators to find in the winter—luckily, the hares have lots of tricks up their, uh, coats. For instance, on the way to a form, a hare will stop to jump back and forth to make lots of new tracks right next to the old ones. This action, sometimes called "hooking," distracts predators from the single tracks headed to the form. Plus, the bunches of tracks also create a confusing scent that makes it less likely for a predator to locate a hare's resting spot.

Hares will also flee from predators in wide, irregular loops so their tracks are difficult to follow. They'll hop in circles hundreds of yards away from their form, following the same path over and over. "That makes it harder for the predator to sniff out the freshest track when the hares are constantly crossing over their own tracks," Pedersen says.

BECAUSE OF THE WAY A MOUNTAIN HARE HOPS, ITS BACK LEGS MAKE TRACKS IN FRONT OF ITS FORELEGS.

Mountain hares roll in the snow to keep their winter coats clean.

Mountain hares can have up to four litters of one to three babies a year.

EATING TWIGS

Mountain hares hum to communicate with each other.

A female mountain hare is called a jill, and a male is called a jack.

Mountain hares are also called tundra hares, snow hares, blue hares, or alpine hares.

5 NOT-SO-PICKY EATERS

Mountain hares are less picky about what they eat in the winter, which helps them survive when food is harder to find. They use their front paws to clear snow from buried plants and their sharp teeth to slice through heather, leaves, and twigs. And even though it's chillier at night, hares prefer to chow down in the dark to avoid predators.

Most of the food that mountain hares eat isn't easy to digest, especially in wintertime when vegetation can be dried out. To get more of the nutrients they need, hares do something called "refection"—pooping out partially digested food to eat it again.

"A hare starts eating as soon as waste comes out, allowing the animal to get more vitamins and minerals on the second pass," Bedson says. "It sounds disgusting, but it's totally natural."

IN THEIR WINTER COATS, HARES STAND OUT IN SPRING.

A HAIRY SITUATION

As the planet warms because of climate change, winters are becoming shorter in some places—like where many mountain hares live. That means fewer days when snow is on the ground. And that's bad news for mountain hares.

Why? The hares are still growing in and shedding their white coats at the same times each year. That means for more days, they have white fur when snow *isn't* on the ground, which makes them easier for predators to spot. "It used to be good for them to be white in winter," wildlife biologist Marketa Zimova says. "But with less snow, their white fur backfires."

Scientists are working on ways to fight climate change to make sure that animals like hares can keep chilling out in their habitats. In some places where mountain hares live, that includes planting more vegetation, which helps keep the Earth from heating up because plants absorb climate-warming carbon dioxide. More vegetation also means more food to keep hares hopping throughout their hillside homes.

Where mountain hares live

PLAY A WILDLIFE PUZZLE GAME!
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THE TRUTH BEHIND THE NEW MOVIE WISH

BY LAURA GOERTZEL

In the new movie *Wish,* 17-year-old Asha lives in a peaceful kingdom called Rosas, where wishes magically come true. But only King Magnifico has the power to decide whose wishes are granted. So when she wishes upon a star for something that angers the king and threatens his rule, Asha must stand up for what's right to save her home.

Of course, wishes don't magically come true in real life. But the kingdom of Rosas was inspired by the real-life food, music, and history of the people who migrated to the Iberian Peninsula, a landform in Europe that includes the countries of Spain and Portugal.

For thousands of years, people traveled to this region searching for natural resources like gold, silver, and iron. Ancient Romans came around the second century B.C.; nearly a thousand years later, people arrived from North Africa. By the 14th century, so many people from so many places had settled here that the region developed its own special culture, which still exists today.

How well does the real-life culture of the Iberian Peninsula measure up to the fictional world of Rosas? *Nat Geo Kids* went behind the scenes to find out.

ASHA

Natural Bling

Whether she's hanging out with best friend Dahlia or playing with Valentino the goat, Asha is always wearing her treasured red coral necklace. Real red coral does actually grow near the coastlines of Portugal, Spain, Morocco, and Algeria. And for thousands of years, people harvested the living coral and turned its red skeleton into valuable jewelry. (Today, red coral is protected in many areas.) In fact, archaeologists in Spain uncovered bits of the bright red coral in 2,500-year-old ruins.

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Sweet Treat

Asha's mom, Sakina, bakes Asha's grandfather a cake *(above)* that's dusted with powdered sugar and decorated with orange slices and raspberries. It turns out the treat is based on a real dessert from Morocco called *meskouta* that's made with olive oil instead of butter. Why? After separate conflicts with Spain and France, butter had become scarce in Morocco by the early 1900s.

Building Style

In one scene, Asha proudly shows off Rosas' market, plaza, and central fountain to a group of visitors. The kingdom actually looks a lot like real-life towns throughout the Iberian Peninsula and North Africa. In fact, the style was brought to the Iberian region by people from North Africa called the Moors. Archways that look like keyholes *(like the five at left)* and geometric flower patterns *(like the wall decoration top right)* are common in many buildings created by people who practice Islam, as the Moors did.

Talking Goat

Asha can tell by her pet goat's constant *baa*-ing that the animal wishes he could talk. So when Valentino's wish really *does* come true, the suddenly chatty goat is thrilled! Goats don't talk in real life, of course, but they do communicate. For instance, the Iberian ibex, a wild goat native to the Iberian Peninsula, uses body language and bleats to warn the herd about danger. When one spots a potential threat, it lifts it head, points its ears toward the trouble, and makes a high-pitched whistle. Then the herd flees up the mountain cliffs, where they're harder to chase.

VALENTINO

IBERIAN IBEX

Music Magic

Asha's grandfather, Sabino, loves to play his lute, an instrument that looks sort of like a guitar. In real life, a lute-like instrument called an oud (pronounced OOD) was brought to the Iberian region by people migrating from North Africa in the seventh century. Like the one Sabino plays *(above)*, a lute looks like an oud, with one big difference: a lute has bars called frets on its neck; an oud's neck is thinner with no frets.

GLOWWORM CAVE

How these insects create a glittery underground world

BY JAMIE KIFFEL-ALCHEH

A river flows through a dimly lit cave in New Zealand. It's so dark that you can't see the water from your boat—you can only hear it. Then, as your boat turns a corner, thousands of twinkling blue-green lights appear overhead.

This is Glowworm Grotto, part of the Waitomo Caves network on the North Island of New Zealand. The spot's shimmering lights look otherworldly, but they're actually created by a species of insect found only in New Zealand. How do these bugs put on such a cool light show? Read on to find out.

LIGHTS ON

Waitomo's limestone caves have existed for about 30 million years. But humans only discovered them some 400 years ago, when the Maori (MOW-ree)—the first people to come to New Zealand—found the cave system's entrance. Still, nobody explored the underground network until Maori chief Tane Tinorau and English explorer Fred Mace built a raft in 1887 to float through part of the 180 miles of pitch-dark caves.

Below the Earth's surface, Tinorau and Mace found a surprise: Some of the walls and ceilings were sparkling like stars. The dazzling display was coming from thousands of insects called New Zealand glowworms.

GLOW ON, 'WORMS'

These glowworms aren't actually worms, though. They're the larvae of fungus gnats, a type of fly about the size of a mosquito. "Similar to how caterpillars eventually become butterflies, these larvae will one day become flies," biochemist Kurt Krause says.

Adult fungus gnats lay their eggs in Waitomo Caves because they're a good spot for larvae to hunt after they hatch. "The larvae build delicate snares to catch their meals," Krause says. These snares work best in calm, wind-free habitats like caves to lure buggy prey like midges.

Here's how it works: A single glowworm—which grows to the length of two U.S. nickels placed side by side—makes dozens of long, silky-looking fishing lines in its mouth and hangs them from a cave ceiling. Then it spits droplets of mucus to make the lines sticky.

Next, the bug emits its blue-green light thanks to a chemical reaction in the creature's tail. (Animals that glow like this are called bioluminescent—pronounced by-oh-loo-meh-NEH-sent.)

Wellington, New Zealand, is the southernmost national capital on the planet.

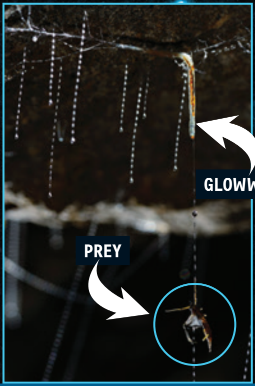
New Zealand has more sheep than people.

The Maori—the first people to come to New Zealand—call the island nation "Land of the Long White Cloud."

Hunting, Glowworm-Style

TO CATCH PREY, GLOWWORMS HANG THESE STICKY SNARES FROM CAVE CEILINGS.

THE LARVAE THEN LIGHT UP TO ATTRACT PREY TO THE "FISHING LINES."



LURED BY THE LIGHT, AN INSECT GETS STUCK ON THE MUCUS-DOTTED TRAP.

The glowing light attracts other insects, which then get trapped on the sticky threads.

That's when the glowworm zips down to snatch its snack. And when thousands of glowworms do this at once, tourists watching from below get an amazing light show.

GLOW GUARDIANS

But too many tourists can be bad for the glowworms' habitat. Carbon dioxide from people's breath can damage the limestone walls that the glowworms hang their snares from.

That's why Native cave guides like Hiria Kohe-Love are working to protect the caves' most famous residents.

"We've put sensors underground so we can monitor the temperature, humidity, water levels, carbon dioxide levels, and wind speed in the caves," says Kohe-Love, a great-great-great granddaughter of Chief Tinorau, Waitomo's first explorer. "If conditions aren't good for the glowworms, we'll delay tours."

Most of the other guides are also related to Tinorau and consider themselves *kaitiaki* (ky-tee-AH-kee), or guardians of the caves. "We look after this spot for future generations," Kohe-Love says. "To us, these caves are *taonga* (ton-GUH), or treasure—they're cherished."

© 2021 SHAUN JEFFERS (MAIN IMAGE); BRIAN ENTING / SCIENCE SOURCE (STICKY SNARES); JULIAN MONEY-KYRLE / ALAMY (GLOWWORM CLOSE-UP); SOLVIN ZANKL / NPL / MINDEN PICTURES (TRAPPED PREY); MARTIN WALZ (MAP)

FLUSHED AWAY

Follow your toilet water as it goes from cruddy to clean.

BY ALLYSON SHAW
ART BY CLAYTON HANMER

Every facility has its own equipment and process—this is a peek into just one type.

Are you reading this magazine on the toilet? Hey, that's perfect! Because we're about to go on a journey that follows your ... *you* know.

After you shower, wash dishes, or flush the toilet, that soapy, foody, poopy water flows through pipes in your home to a sewer that runs beneath the street. It might move through miles of pipes—some large enough to fit a car—before arriving at your local wastewater treatment facility. This is where your water will go from cruddy to clean. Dive in to learn more. (But first—wash your hands!)

1. CLEAN SCREEN

At the treatment facility, dirty wastewater first passes through **screens made of metal bars** that sort out solid pieces of trash like **flushable wipes, plastic, and other junk.** (Workers call this stuff "rags.") Wastewater staff send the rags to incinerators or landfills, while the poopy, dirty water keeps flowing.

2. ROCK REMOVAL

Next, water flows into a 15-foot-deep pool called **a grit chamber.** Machines pump in compressed air, which creates bubbles that flow in a spiral pattern across the pool. As the bubbles spin, heavier things like **gravel, bits of rocks, and sand fall to the bottom—**they'll go to a landfill—while everything else passes on to the next stage.

3. POO BE GONE

For about three hours, the water slowly moves through circular pools called **clarifiers** that can be over 300 feet wide. Here, lighter materials like **soap, grease, and oil** (called scum) rise to the top, while heavier stuff like **poop** (called sludge) falls to the bottom. **A device skims the surface** and collects the scum; **rakes at the bottom** remove the sludge. (The sludge might be turned into compost or burned for energy.)

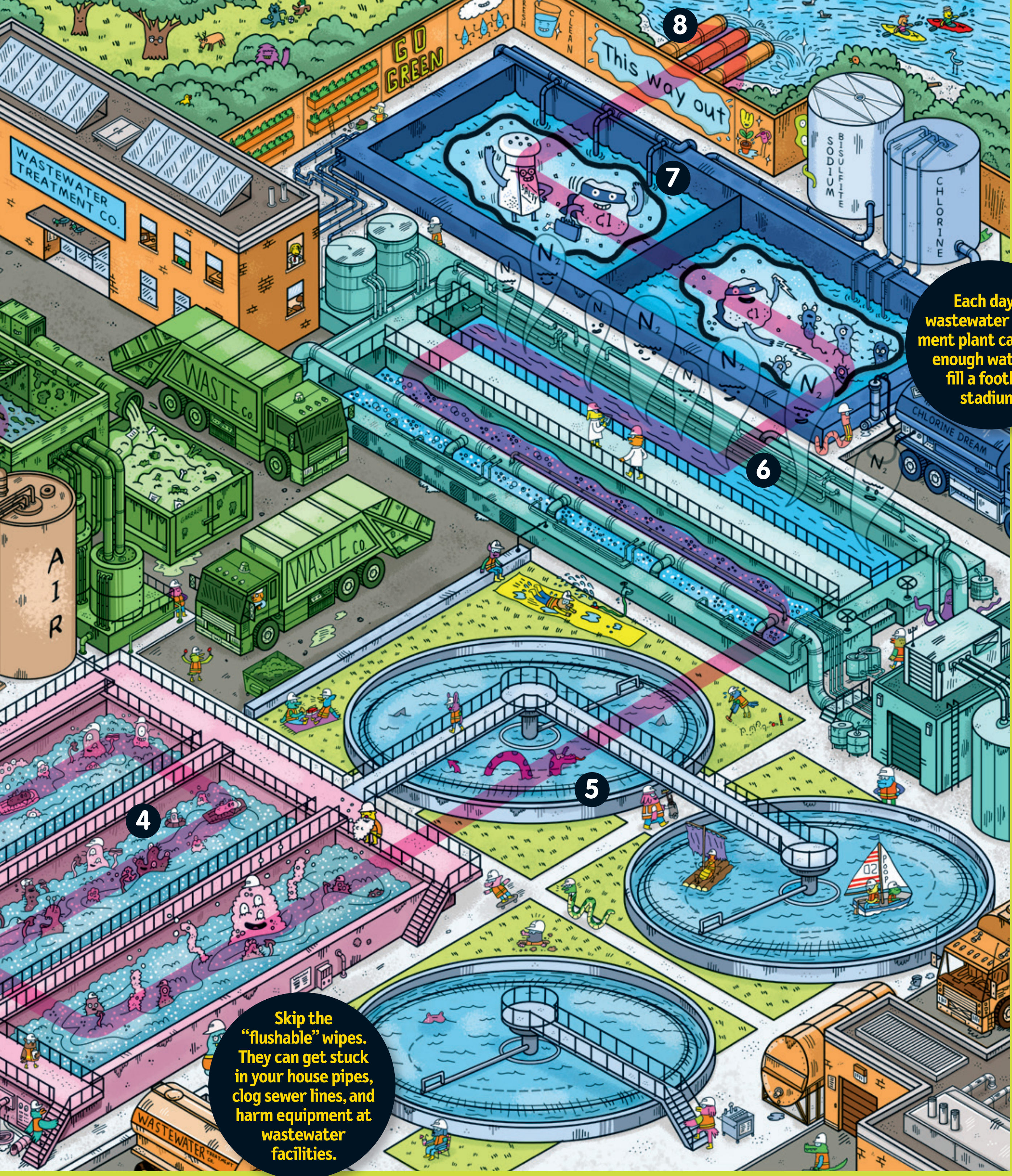
4. BACTERIA BUDS

The next stop is a series of large, bacteria-packed pools called **aeration basins.** Like giant hot tubs, the pools are constantly filled with air bubbles to provide oxygen to bacteria, which then happily eat whatever organic material is suspended in the water. **(That means you, poo!)**

5. CLARIFIED, AGAIN

The water flows into another **set of clarifiers** to remove more sludge and scum.

ART REVIEWED BY RYU SUZUKI, DIRECTOR OF WASTEWATER ENGINEERING, DC WATER



Each day, a wastewater treatment plant can clean enough water to fill a football stadium.

Skip the "flushable" wipes. They can get stuck in your house pipes, clog sewer lines, and harm equipment at wastewater facilities.

6. PEE-FREE

Human urine is full of **nitrogen,** a chemical that all living things need to survive. The problem? Too much nitrogen in lakes and rivers (where the cleaned wastewater will end up) can supercharge the growth of algae, which blocks out sunlight and prevents other water plants from growing. So the facility uses **a process called denitrification** that helps other types of bacteria convert the nitrogen from a liquid into a gas.

7. DISINFECTION

Facility workers add an **element called chlorine** to the water to kill **viruses, parasites, and germs** that can make humans and animals sick. Once the water is clean, workers pour **a salt called sodium bisulfite** into the water to neutralize the chlorine so that it won't harm any organisms when the water is released. (This happens at a microscopic level, unlike the silly illustration above!)

8. BACK TO NATURE

After about 36 hours at the treatment facility, the now-clean water is **released into a lake or river.** This water might end up back in your faucet—but first, it will flow into *another* treatment facility to make sure the water is totally safe to drink. It's like the ultimate recycling project!

game on

Playtime is serious business for Asian small-clawed otters.

BY CRISPIN BOYER

Excited squeals and chirps ring out in a rainforest in Indonesia, a country in Southeast Asia. A family of Asian small-clawed otters bounds up a muddy riverbank before plopping on their bellies, then *whoosh!* The otters slide into the water with a splash.

"It's great fun to watch them," otter biologist Nicole Duplaix says. "They're always rambunctious, always busy."

Turning a muddy hill into a waterslide is just one way Asian small-clawed otters like to play. Take a peek at some of their silliest antics—and why the goofy games are sometimes about more than just having fun.

the play: juggling

Asian small-clawed otters are known for their rock-rolling abilities. Lying on their backs, these otters use their nimble paws to roll stones across their chests. "And one of the animals we studied performed the behavior standing up, using his front paws to bounce rocks off of the wooden walls of his shelter," otter researcher Mari-Lisa Allison says.

Asian small-clawed otters are one of three otter species with paws that can grip objects, similar to a raccoon's paws. So though all otter species use both their mouths and paws to interact with the world, these otters rely especially on their hands to hunt and explore. "They love using their paws: to look under a rock, groom themselves, scratch their chests, or play with rocks and leaves," Duplaix says.

Scientists have also suggested that young otters might "juggle" rocks to improve hunting skills like snatching crabs and opening clams. And older otters might perform the trick to keep their minds and reflexes sharp. "It might just feel nice and be relaxing!" Allison says. Maybe it's like an otter fidget spinner!

C JELLIS PHOTOGRAPHY / ALAMY (JUGGLING); KRYS BAILEY / ALAMY (OTTER PLAYING WITH PEBBLE); MARTIN WALZ (MAP)

the play: sliding

The world is one big playground for Asian small-clawed otters. These sleek animals often tuck their stubby legs close to their bodies to slide down mudbanks or creeks. When they reach the bottom, they'll sometimes bound back up the hill for another ride.

Although dashing downhill on their furry bellies is a form of play, these otters sometimes slip down slopes for more useful reasons. "It uses less energy than running or walking," Duplaix says, "especially when you have short legs like this species."

Otters also plan their downhill runs, looking before they leap. "They need the right angle," she adds. "They don't want to get stuck or land on their heads."

Asian small-clawed otters are the smallest of the 13 otter species.

Crocodiles and snakes hunt these otters.

the play: wrestling

ADMIT DEFEAT!

Sometimes otter play can get rough. They twist and tumble, try to pin each other, nip at one another's fur, and growl and squeal. But though their jaws are strong enough to crush crab shells, otters don't hurt each other when they play—their fur is too thick, plus they're not really in full fight mode. And just as quickly as each wrestling match starts, it's over. "Something usually catches their attention and they run off," Duplaix says. "They get distracted."

Parents are in charge of otter family groups, and the older siblings look after the younger pups. Otter horseplay builds bonds between family members and helps show who the top otters are. Plus, wrestling teaches otters important skills.

"Wrestling is most common among the younger ones," researcher Alex Saliveros says. "They learn to copy the behavior of otters they have close bonds with." That means young otters learn moves to escape predators by roughhousing with their older siblings.

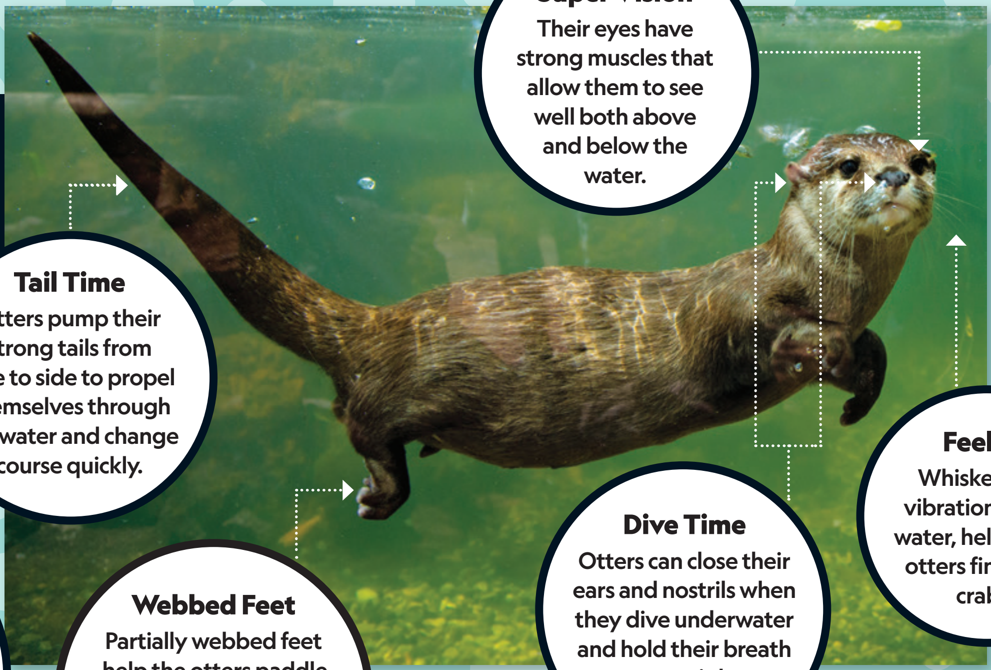
the play: chitchatting

Cooing, grunting, squealing, growling: These otters have a lot to say! Most otter species have a vocabulary of at least 12 sounds, but Asian small-clawed otters put lots of vocal twists on those sounds. That means they have many more "words." "They're constantly chatting," Duplaix says.

These otters live in family groups of up to 20 individuals, and they need to tell each other what's going on as they forage for food, defend their territory, and watch for danger. For example, they snort if they see something dangerous, which tells the group to scatter. And when they're hungry, they let everyone know with a loud squeal. "Feeding times are very noisy!" Allison says.

swim champs

See the adaptations that help Asian small-clawed otters excel in the water.



Super Vision
Their eyes have strong muscles that allow them to see well both above and below the water.

Tail Time
Otters pump their strong tails from side to side to propel themselves through the water and change course quickly.

Feel Ya
Whiskers feel vibrations in the water, helping the otters find tasty crabs.

Dive Time
Otters can close their ears and nostrils when they dive underwater and hold their breath up to eight minutes.

Fur Babies
Otters have two layers of thick fur: The inner layer keeps them cozy in chilly water, and the oily, waterproof outer layer keeps them dry.

Webbed Feet
Partially webbed feet help the otters paddle in the water and pick up small objects.

WATCH A YAWNING OTTER VIDEO!
natgeokids.com/november

SUPAWIT SRETHBHAKDI / SHUTTERSTOCK (SLIDING); PAUL A CARPENTER / SHUTTERSTOCK (WRESTLING); LINDA KENNEDY / ALAMY (CHITCHATTING); EDWIN GIESBERS / NPL / MINDEN PICTURES (SWIM CHAMPS); SCHERF / FACE TO FACE / AGE FOTOSTOCK (FOOT)

FUN STUFF

GAMES, LAUGHS, AND LOTS TO DO!

QUIZ YOUR NOODLE

Don't let your mind hibernate this fall. Test your seasonal smarts with these brainteasers.

ANSWERS ON PAGE 31

1 CRAZY CARROTS

Twenty-seven carrots are below. Use your noodle to remove 18 of them to make 10.

3 SQUASHED

Look at the locations of the gourds in each group. Figure out where the gourds should be placed in the fourth group based on the patterns of the other three.

5 APPLES ON THE BRAIN

How can you make every other basket full by moving the apples from only one basket?

RUTH A. MUSGRAVE (CONCEPT); HORTIMAGES / SHUTTERSTOCK (MAROON CARROT); AKEPONG SRICHAICHANA (PURPLE CARROT); ENLIGHTENED MEDIA / SHUTTERSTOCK (ORANGE CARROT); KARIPHOTO / SHUTTERSTOCK (YELLOW CARROT); MIKEMAKARENKO / SHUTTERSTOCK (GREEN AND ORANGE SQUASH)

2 STACK ATTACK

These hay bales are perfect for a hayride. But the driver says you need a total of 20 bales. How many more do you need?

4 FOOD FOR THOUGHT

Figure out the hidden phrases in these food puzzles.

A. maze

B. Left
Food

C. POT OOOO
OOOO

D. Soup

E. PumPkinPie

WILDLIFE GMBH / ALAMY (GREEN AND WHITE SQUASH); SLOWMOTIONGLI / SHUTTERSTOCK (RED SQUASH); LABOKO / SHUTTERSTOCK (STRIPED SQUASH); SHSPHOTOGRAPHY / GETTY IMAGES (BASKET); MICHAEL BURRELL / GETTY IMAGES (APPLES); LIGHTSPRING / SHUTTERSTOCK (HAY); ANDREY JITKOV / SHUTTERSTOCK (CORN)

Animal BLOOPERS

Animals make mistakes, too!

BY ALLYSON SHAW

African elephant

RANGE Central and southern Africa

SLIPUP SPOT San Diego Zoo, California

PHOTO FAIL Baby elephants can walk an hour after they're born—but that doesn't mean they've mastered the skill yet.

King penguin

RANGE Islands surrounding Antarctica

SLIPUP SPOT The island of South Georgia, in the South Atlantic Ocean

PHOTO FAIL These birds sometimes travel by tobogganing, or sliding on their bellies. Maybe this penguin is testing out a new way to get around?

Red deer

RANGE Europe and West Asia

SLIPUP SPOT Haute Vallée de Chevreuse Regional Natural Park, France

PHOTO FAIL In late summer, deer rub their antlers on trees to remove the bony stuff's soft outer layer, called velvet. But it looks like the *tree* rubbed off on this deer.

ZSSD / MINDEN PICTURES (ELEPHANT); BEN CRANKE / NPL / MINDEN PICTURES (PENGUIN); THIERRY LE QUAY / BIOSPHOTO / MINDEN PICTURES (DEER)

LAUGH OUT LOUD

Answers

"Quiz Your Noodle" (pages 28-29):

1. "Crazy Carrots"

2. "Stack Attack" You need two more bales.

3. "Squashed"

4. "Food for Thought"

A. corn maze

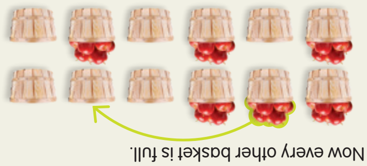
B. leftover food

C. potatoes (pot + 8 o's)

D. split pea soup

E. piece (p's) of pumpkin pie

5. "Apples on the Brain" Move the apples from the second basket into the fifth basket. Now every other basket is full.



CHRIS WARE (ALL)

Whatcha Think?

Check out how *Nat Geo Kids* readers responded to this poll!

Which dinosaur do you like most?

32% TYRANNOSAURUS REX

27% SPINOSAURUS

20% VELOCIRAPTOR

12% TRICERATOPS

9% STEGOSAURUS

PARENTS! GO ONLINE FOR A CHANCE TO WIN THIS RUG FOR YOUR KID.
natgeokids.com/giveaways

NO PURCHASE NECESSARY. Begins on 10/18/23 at 8 a.m. ET and ends on 10/25/23 at 11:59 p.m. ET or until 5 eligible entrants are verified, whichever is earlier. First come, first served. Open to 50 U.S./D.C.; 18+; with children ages 6-14. **SUBMISSIONS MUST BE EMAILED BY YOUR PARENT/LEGAL GUARDIAN.** Void where prohibited. Sponsor: National Geographic Partners, LLC, 1145 17th St., NW, Washington, DC 20036. Rules/odds: https://natgeokids.com/giveaways

FRANCO TEMPESTA (ALL ART)

BACK TALK

1. **Fill in** the thought balloon.
2. **Cut out** the entire picture (or make a photocopy of it).
3. **Mail** it along with your name, address, phone number, and date of birth to **Nat Geo Kids, Back Talk, P.O. Box 96000, Washington, DC 20090-6000.** Selection for publication in a future issue will be at the discretion of *Nat Geo Kids.*

What do YOU think this Galápagos tortoise is thinking?

FROM THE MARCH 2023 ISSUE

Raise your hand if you're ready for summer!
John J., 8
Cleona, Pennsylvania

I think I need to sneeze!
Genevieve B., 8
Tallahassee, Florida

Taxi!
Eli B., 14
Plum City, Wisconsin

Hold on for one "marmot."
Nina L., 12
Washington, D.C.

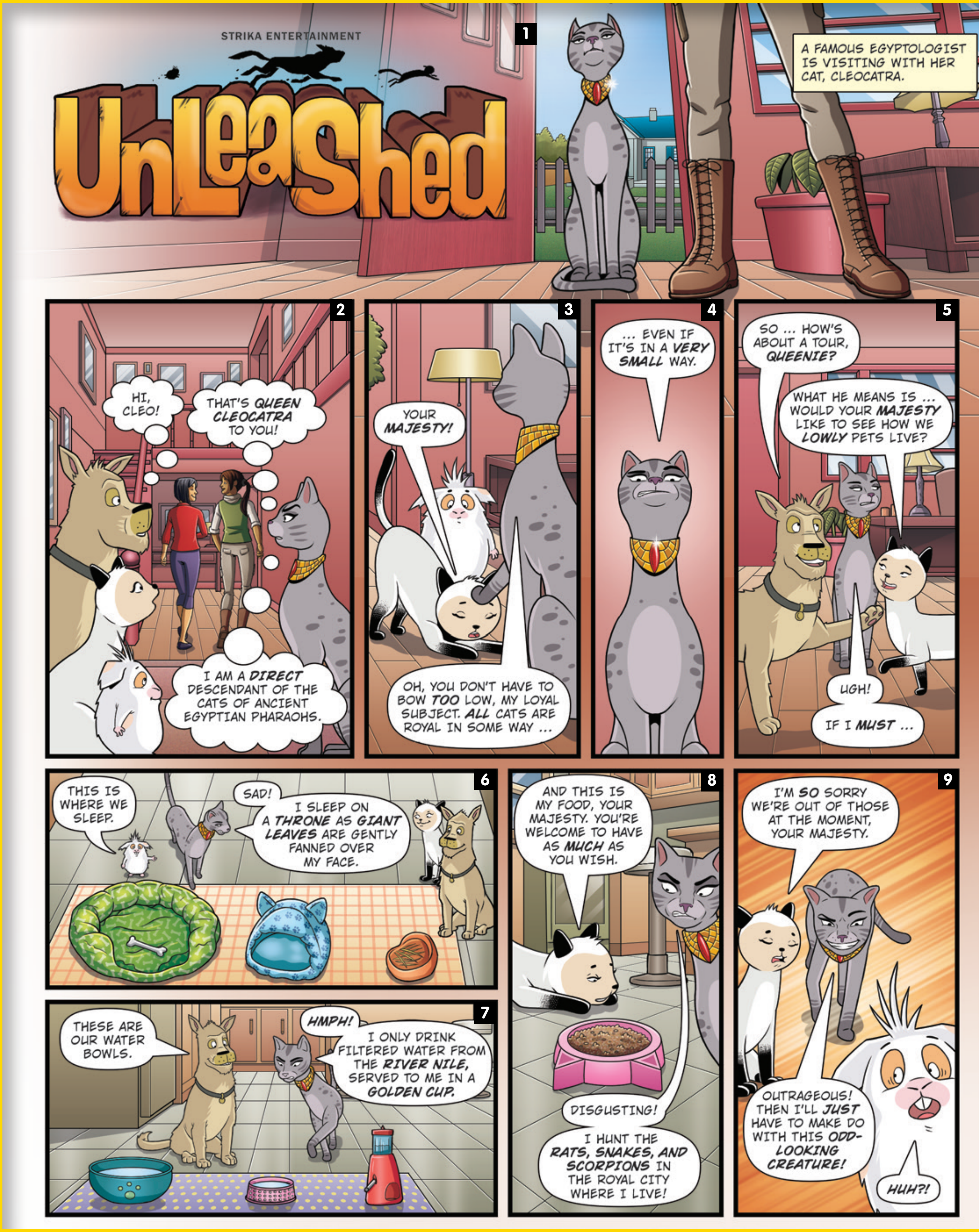
Four squash and seven yams ago …
Issac S., 11
Marathon, New York

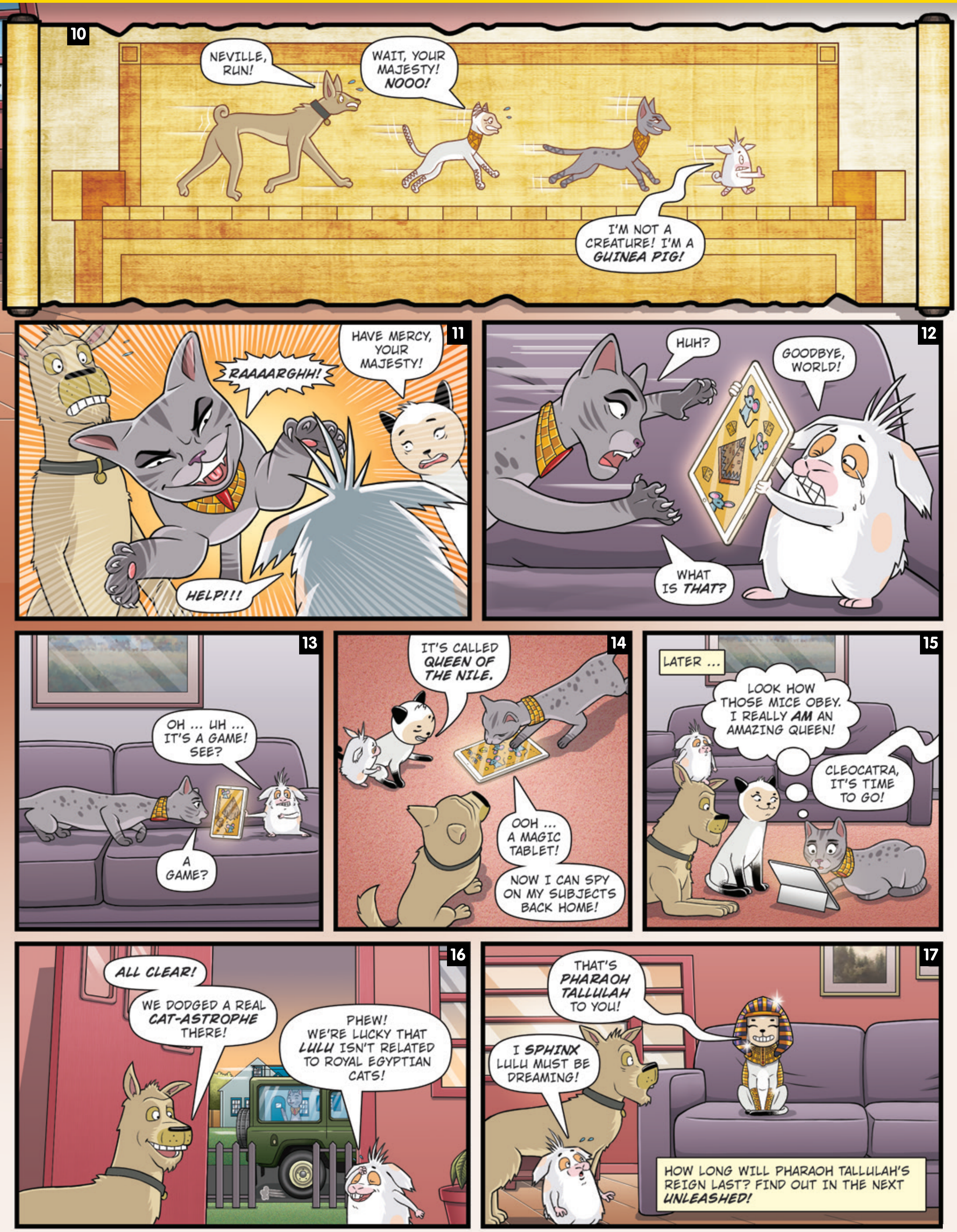
Mic drop!
LillyMae P., 14
Springboro, Ohio

May I use the bathroom?
Grayson W., 11
McCall, Idaho

Stop! Animal *paw*-trol!
Lizzie H., 11
New Orleans, Louisiana

TUI DE ROY / MINDEN PICTURES (GALÁPAGOS TORTOISES); DONALD M. JONES / MINDEN PICTURES (HOARY MARMOT)


STRIKA ENTERTAINMENT
Unleashed
1
A FAMOUS EGYPTOLOGIST IS VISITING WITH HER CAT, CLEOCATRA.
2
HI, CLEO!
THAT'S QUEEN CLEOCATRA TO YOU!
I AM A DIRECT DESCENDANT OF THE CATS OF ANCIENT EGYPTIAN PHARAOHS.
3
YOUR MAJESTY!
OH, YOU DON'T HAVE TO BOW TOO LOW, MY LOYAL SUBJECT. ALL CATS ARE ROYAL IN SOME WAY ...
4
... EVEN IF IT'S IN A VERY SMALL WAY.
5
SO ... HOW'S ABOUT A TOUR, QUEENIE?
WHAT HE MEANS IS ... WOULD YOUR MAJESTY LIKE TO SEE HOW WE LOWLY PETS LIVE?
UGH!
IF I MUST ...
6
THIS IS WHERE WE SLEEP.
SAD!
I SLEEP ON A THRONE AS GIANT LEAVES ARE GENTLY FANNED OVER MY FACE.
7
THESE ARE OUR WATER BOWLS.
HMPH!
I ONLY DRINK FILTERED WATER FROM THE RIVER NILE, SERVED TO ME IN A GOLDEN CUP.
8
AND THIS IS MY FOOD, YOUR MAJESTY. YOU'RE WELCOME TO HAVE AS MUCH AS YOU WISH.
DISGUSTING!
I HUNT THE RATS, SNAKES, AND SCORPIONS IN THE ROYAL CITY WHERE I LIVE!
9
I'M SO SORRY WE'RE OUT OF THOSE AT THE MOMENT, YOUR MAJESTY.
OUTRAGEOUS! THEN I'LL JUST HAVE TO MAKE DO WITH THIS ODD-LOOKING CREATURE!
HUH?!


10
NEVILLE, RUN!
WAIT, YOUR MAJESTY! NOOO!
I'M NOT A CREATURE! I'M A GUINEA PIG!
11
RAAAARGHH!
HAVE MERCY, YOUR MAJESTY!
HELP!!!
12
HUH?
GOODBYE, WORLD!
WHAT IS THAT?
13
OH ... UH ... IT'S A GAME! SEE?
A GAME?
14
IT'S CALLED QUEEN OF THE NILE.
OOH ... A MAGIC TABLET!
NOW I CAN SPY ON MY SUBJECTS BACK HOME!
15
LATER ...
LOOK HOW THOSE MICE OBEY. I REALLY AM AN AMAZING QUEEN!
CLEOCATRA, IT'S TIME TO GO!
16
ALL CLEAR!
WE DODGED A REAL CAT-ASTROPHE THERE!
PHEW! WE'RE LUCKY THAT LULU ISN'T RELATED TO ROYAL EGYPTIAN CATS!
17
THAT'S PHARAOH TALLULAH TO YOU!
I SPHINX LULU MUST BE DREAMING!
HOW LONG WILL PHARAOH TALLULAH'S REIGN LAST? FIND OUT IN THE NEXT UNLEASHED!

NATIONAL GEOGRAPHIC KiDS

Awesome Animals!

GREATER FLAMINGO

TEXT BY RUTH A MUSGRAVE

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GREATER FLAMINGO

A **A greater flamingo's wing tips couldn't reach each side of a washing machine.**
FALSE. With its 60-inch wingspan, it could reach beyond the width of two washing machines standing side by side.

B **As they eat, greater flamingos look as if they're about to do a headstand.**
TRUE. They hold their heads upside down, dipping their beaks and tongues into the water to filter out food.

C **Flamingo nests resemble volcanoes.**
TRUE. Flamingo parents build 12-inch-tall mud mounds to keep eggs dry and cool.

D **A flamingo hides from underwater predators by standing on one leg.**
FALSE. The bird holds one leg close to its body to help keep warm.

E **Heavy legs and a long neck make long flights impossible for the birds.**
FALSE. Greater flamingos often fly more than 350 miles a night during migration.

PETE OXFORD / NATURE PICTURE LIBRARY

NATIONAL GEOGRAPHIC KIDS

Awesome Animals!

WHITE RHINOCEROS

WHITE RHINOCEROS

A **A large white rhino would not fit inside a soccer goal.**
FALSE. At 15 feet long, one could fit inside a pro soccer goal with nine feet to spare.

B **There are millions of white rhinos.**
FALSE. Overhunting almost caused their extinction. They've made a comeback, however, thanks to conservation efforts. Today, there are about 16,000 white rhinos.

C **Your fingernails grow a lot faster than a rhino's horn.**
FALSE. Horns grow at about the same rate as your fingernails—one to two inches a year.

D **Rhinos are likely to take a mid-day rest in the mud.**
TRUE. Wallowing in mud helps keep them cool in the hot African sun.

E **If you had a pet rhino, you'd never have to mow the lawn.**
TRUE. A rhino devours 50 to 75 pounds of grass each day.

JOHN CANCALOSI / NATURE PICTURE LIBRARY

NATIONAL GEOGRAPHIC KIDS

Awesome Animals!

SALLY LIGHTFOOT CRAB

SALLY LIGHTFOOT CRAB

A These crabs live in deep waters.
FALSE. Sticking to shorelines, they dip into shallow water just to wet their gills.

B The dainty eaters dine only on algae.
FALSE. Although they do eat a lot of algae, they also eat small animals, dead or alive. The big crabs even eat smaller crabs.

C "Lightfoot" in their name is a joke because they're actually clumsy.
FALSE. These agile crabs easily jump and scurry up and down rocks. Some people think they were named after a dancer.

D This feisty-looking crab is only about the size of a house key.
FALSE. A Sally Lightfoot crab is about eight inches wide—about the same as four house keys laid end to end.

E Some of these crabs share their home with penguins and iguanas.
TRUE. One of the places they thrive is on the Galápagos Islands, also home to Galápagos penguins and marine iguanas.

PETE OXFORD / NATURE PICTURE LIBRARY

Awesome Animals!

MOUNTAIN LION

MOUNTAIN LION

A Mountain lions are cougars.
TRUE. Panther, puma, cougar, and mountain lion are all names used for the same wild cat.

B Male mountain lions can be 20 times larger than a house cat.
TRUE. Males can weigh more than 200 pounds. Females weigh less.

C If you hear a sound like a person screaming, it could be a cougar.
TRUE. These cats do not roar. They growl, hiss, whistle, and sometimes scream.

D Fussy eaters, mountain lions refuse leftovers.
FALSE. These predators hide partially eaten prey under sticks and leaves to snack on for several days.

E Except for the pesky predator thing, a cougar would be a great addition to a high-jump team.
TRUE. They can jump 18 feet up into a tree.

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RED COLOBUS MONKEY

RED COLOBUS MONKEY

A red colobus monkey weighs about as much as you do.
FALSE. It weighs only 11 to 25 pounds.

B There is only one species of red colobus monkey.
FALSE. There are several species that live in parts of Africa.

C If a red colobus monkey invites you to dinner, don't eat the salad.
TRUE. The leaves they eat are hard to digest. The monkeys have a certain kind of bacteria in their specialized stomachs that helps digest the leaves. Humans do not.

D Most of these monkeys would prefer an apartment on the fifth floor to one at street level.
TRUE. Most red colobus monkeys like to be 50 to 90 feet up a tree.

E Red colobus monkeys are the most graceful of all monkeys.
FALSE. They are rather clumsy climbers.

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PUSS MOTH CATERPILLAR

PUSS MOTH CATERPILLAR

A **These insects are called puss moth caterpillars because they're hunted by cats.**
FALSE. The name refers to the caterpillars' furry, kitten-like look.

B **Prince William might see this caterpillar at a family castle.**
TRUE. Puss moth caterpillars are common throughout Great Britain.

C **This caterpillar is about the length of a long french fry.**
TRUE. But the three-inch caterpillar probably isn't as tasty!

D **The puss moth caterpillar's head can puff up.**
TRUE. Its head inflates, causing the false eyespots to grow large and scary to startle predators. Its real eyes are small.

E **Birds easily break in to its co-coon.**
FALSE. The caterpillar weaves wood and bark into a hard cocoon—it's great protection from birds and good camouflage, too.

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